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CONNECTION TO NET OF A THREE PHASE TRANSFORMER IN Y-CONNECTION, IDLE, USING AN ELECTRONIC CONTACTOR

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***Abstract* – This paper presents the results obtained using an electronic contactor designed by us. The electronic contactor establishes the idle connection of a three-phase transformer to the net. The work make obvious the difference between the current variation when the connection is establish in an improper moment (fig. 2, 3, 4) and when the connection is establish in an proper moment (fig. 5, 6, 7).**

***Keywords*:** *electronic contactor, three-phase transformer, optimal connection.*

1. INTRODUCTION

It is known that when an idle connecting of the transformer to the net a blow current I_{0s} of 40 up to 80 times bigger than the idle current from the permanent condition I_{0d} , which means 5-8 times the nominal current I_n[1].

Paper [2] presents an optimizing connection to the net of the three phase transformer with star connection, idle, calculating in certain assumptions the connection angle values of each phase, so that the idle regime of duration to appear right at the moment of each phase connection.
This paper presents the block diagram of the experimental appliance analyzing this phenomenon (Fig.1), as well as the experimental results.

2. THE BLOCK DIAGRAM PRESENTATION OF THE EXPERIMENTAL APPLIANCE

The transformer used in this experiment is a teaching one with the following data: S_n=7 kVA, U_{1fn}=380 V, U_{2fn}=190 V, I_{1n}= 6,1 A, I_{2n}=12,2 A.
The transformer can be either star or triangle connection. The idle current of duration I_{0d} (medium value)is of 0.103 A.

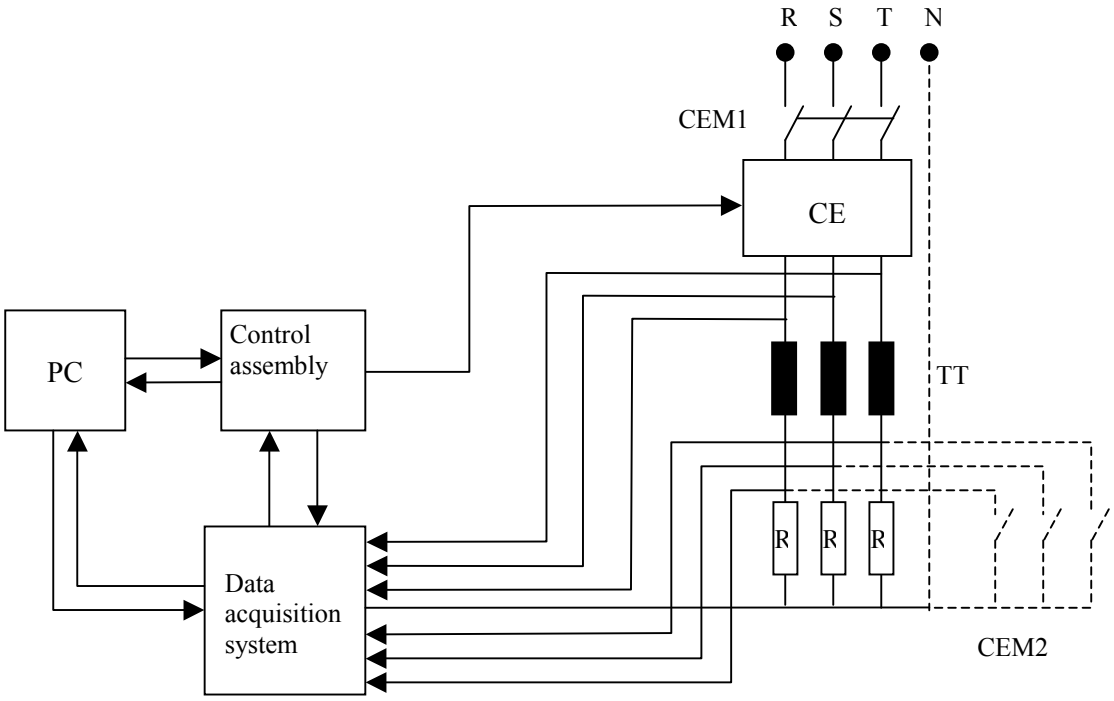

Fig.1. The block diagram of the experimental appliance

The measuring of the idle current of duration on phase (0.11A, 0.08A, 0.12A)
was made with a precision kit SN 3050. The beginnings of the phases are connected to the three phase voltage net through the electro mechanic contactor CEM1 The endings of the phases are connected to the input of the electronic contactor CE, that connects to the null each phase at a certain electric angle, according to an algorithm (see paper 2) using some resistances R for data acquisition.

After the third phase was connected to the null, another electro mechanic contactor CEM2 fulfills in the outside of the electronic contactor CE the star connection, already made (around six periods) by the electronic contactor CE.

The control of the electro mechanic contactor CEM2 can be done automatically by the control block, after about 200ms at the moment of the first phase connection, or manually, after about one second from the electronic contactor CE command .

The electronic contactor CE, that has as executioner elements thyristors assembled in the cross-bar of a rectifying bridge, shuts the circuit of each phase at a certain electric angle, calculated and set by a specialized program.
The command block, built with a micro controller, receives from the PC calculator the angle values to which the thyristors command is made in the electronic contact CE.
The data acquisition system takes over the values of the three phases voltage, of the three currents in the phases, the synchronization reference and a step-voltage from the command block BC , makes their analog-numeric conversion and then transmits this information to the PC computer The PC calculator interprets these data with the help of a specialized soft, offers the entry possibility for the calculated angles, transmits the values of these angles to the command block BC and displays the wave forms of the voltages and currents.

3. EXPERIMENTAL RESULTS

Proceeding with the measuring the blow currents when the transformer is connected to the net, his secondary being idle, the results from table 1 and figures 2-5 were obtained.

Nr.crt	$\alpha_{01(R)}$ [°]	$\alpha_{02(S)}$ [°]	$\alpha_{03(T)}$ [°]	I_{0s} [A]	I_{0s}/I_{0d}	I_{0s}/I_n	Prezentare grafică
1	9	120	240	10	97	1,6	Fig. 2
2	360	360	360	10	97	1,6	Fig. 3
3	9	9	9	9,6	93,2	1,57	Fig. 4
4	90	415	671	1,3	12,62	0,21	Fig. 5
5	90	775	1391	1,0	9,7	0,16	Fig. 6
6	90	1135	2110	0,6	5,82	0,098	Fig. 7

Table 1.

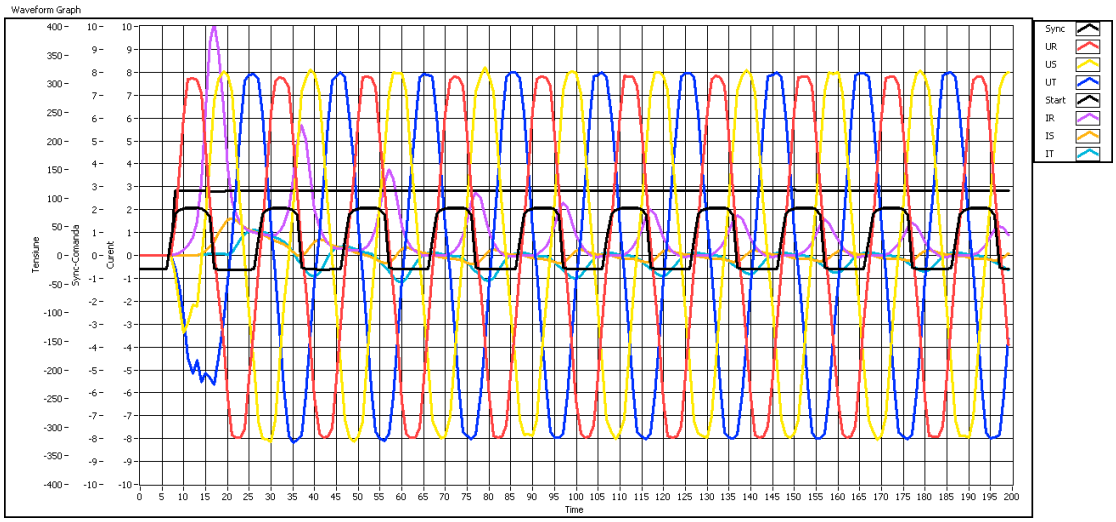

Fig. 2. Connection of the transformer to the net, at the angles of 90, 120, 240

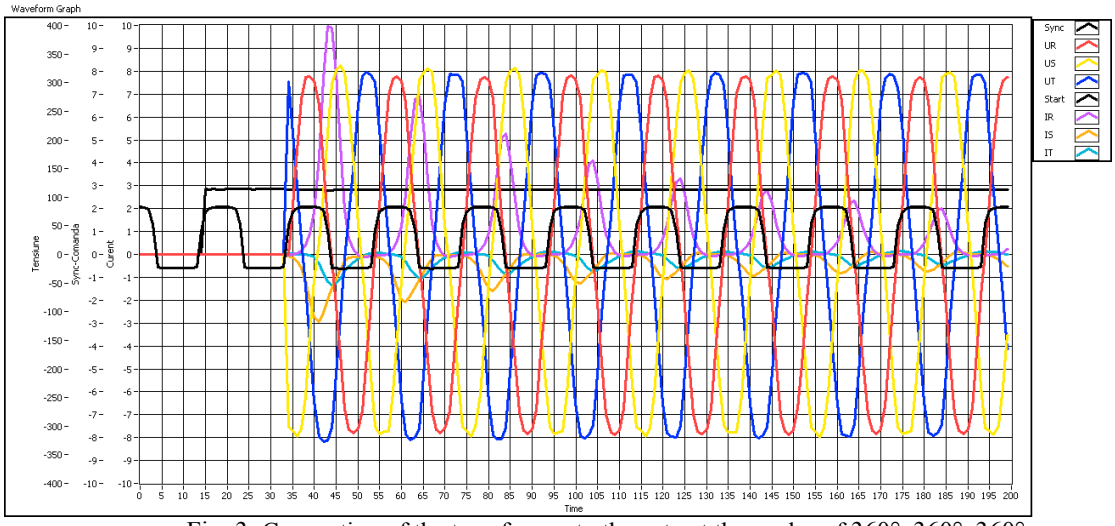

Fig. 3. Connection of the transformer to the net , at the angles of 360°, 360°, 360°.

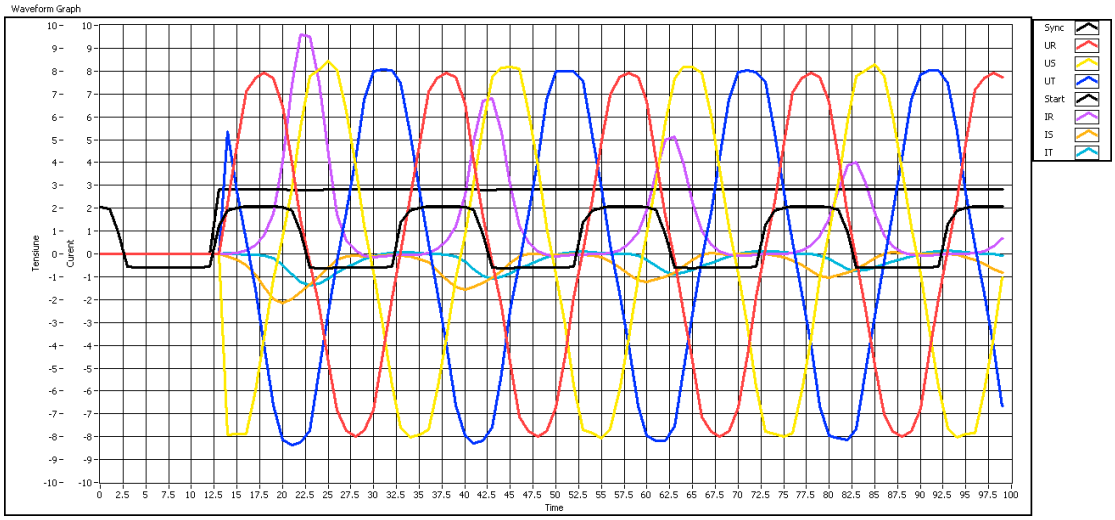

Fig. 4. Connection of the transformer to the net , at the angles of 9°, 9°, 9°.

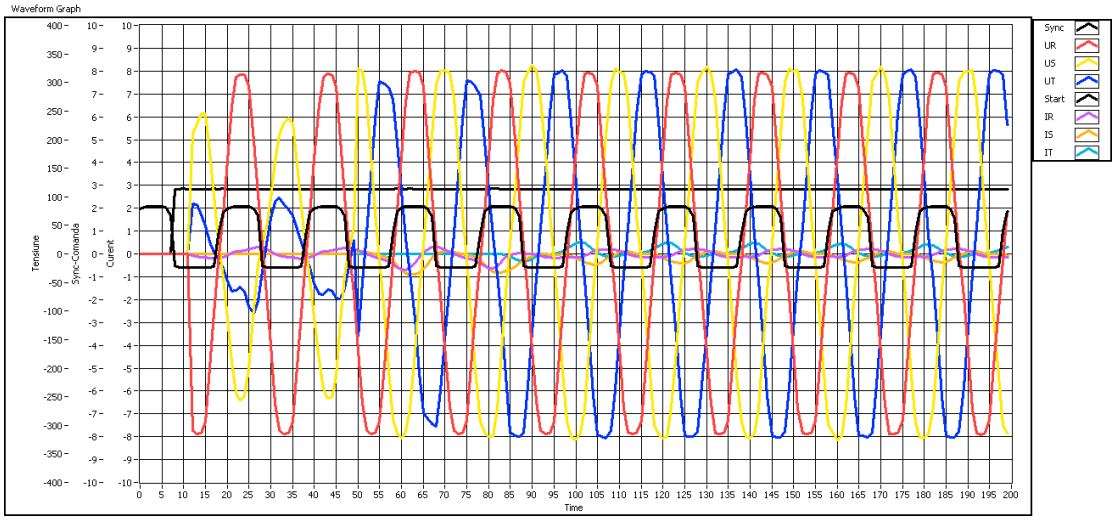

Fig. 5. Connection of the transformer to the net , at the angles of 90°, 415°, 671°.

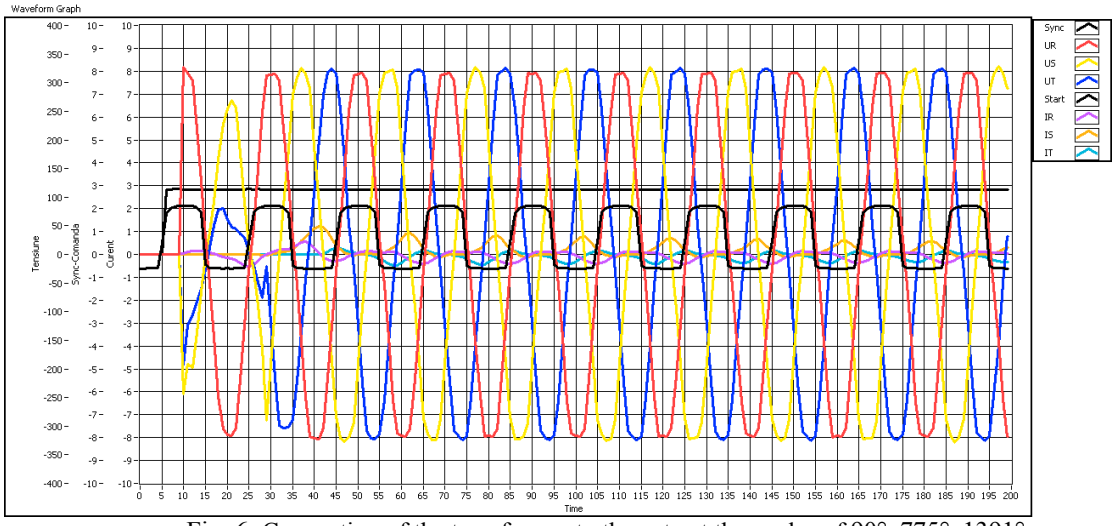

Fig. 6. Connection of the transformer to the net , at the angles of 90°, 775°, 1391°.

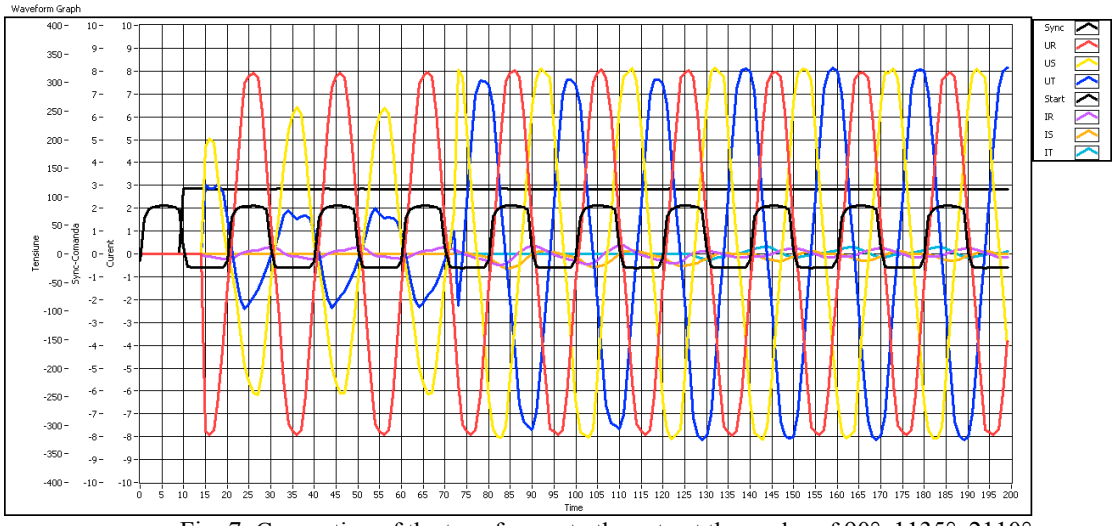

Fig. 7. Connection of the transformer to the net , at the angles of 90°, 1135°, 2110°.

4. CONCLUSIONS

- **I**n the most disadvantageous situations (when the command angle was near to zero of the phase R) , the ratio I_{0s}/I_{0d} was great: 93-97, and I_{0s}/I_n was 1.57-1.6

  When we used the angles calculated in paper 2, without a run of kT period, the ratio I_{0s}/I_{0d} was 12.62, and I_{0s}/I_n was 0.21 (fig. 5). When k=1 (fig6) the ratio I_{0s}/I_{0d} lowered to 9.7, and I_{0s}/I_{0d} to 0.16. For k=2 I_{0s}/I_{0d} 5.82 and I_{0s}/I_n 0.198 were obtained. Without any exaggeration, the smaller the current peaks at the phase connection , the bigger the number of kT periods, if the calculated angles were respected

- The result of the experiment justifies the production of an industrial electronic contactor based on this principle.
- The obtained results were selected from thousands of testing which have proved the validity of the theory presented in paper 2

References

[1] I.Piroi. , *Maşini electrice*, Ed. Didactică şi Pedagogică, Bucureşti, 2004